

Date: 22.11.2019

Time : (2 ½ Hours)

Total Marks: 75

- N.B. (1) All questions are compulsory.
 (2) Figures to the right indicate marks for respective sub questions.

- Q.1) Attempt All (Each of 5Marks) (15)
- (a) Choose correct alternative in each of the following. (5)
- (i) A graph without loops and parallel edges is called as....
 (a) Simple graph (b) Compound graph
 (c) Multigraph (d) None of these
- (ii) If a relation is reflexive, antisymmetric and transitive then the relation is called as....
 (a) Equivalence relation (b) Bijective
 (c) partial order relation (d) None of these
- (iii) Suppose a bookcase shelf has 5 physics texts, 3 chemistry texts, 6 biology texts and 4 mathematics texts. Number of ways a student can select one text of each type is given by...
 (a) 660 (c) 560
 (b) 460 (d) None of these
- (iv) The degree of the recurrence relation $2a_r + 3a_{r-1} = 3$ is.....
 (a) 1 (c) 2
 (b) 3 (d) None of these
- (v) Two vertices u and v in a graph G are said to beeach other if and only if they are the end vertices of the same edge e.
 (a) Adjacent (b) Parallel
 (c) Loop (d) None of these
- (b) Fill in the blanks (5)
 (surjective,35,Poset,tree,injective, $2^5 3^2 5^3 7^1 11^2$)
 (i) A set together with an partial order relation is called as...
 (ii) Inways 4 questions can be selected from 7 questions.
 (iii) An onto function is called as...
 (iv) A connected graph without any cycle is called...
 (v) The Gödel number of a word $w=a_5a_2a_3a_1a_2$ is
- (c) Answer the following in one line (5)
 (i) Product rule
 (ii) Inclusion exclusion principle
 (iii) Partial order relation
 (iv) What is the degree of each vertex in complete graph on 3 vertices?
 (v) Why f from R to R defined by $f(x)=1/(x+1)$, is not a function?

Q.2) Attempt **any THREE** of the following. (15)

- Consider the “divides” relation on a set A of positive integers. Prove that this relation is a partial order relation on A.
- Consider a relation R on R (the set of all real numbers) as follows: For all $x, y \in R$, $x R y$ if and only if $x < y$. Is R an equivalence relation? Prove or give a counter example.
- Consider the “divides” relation on a set $A = \{1, 2, 4, 5, 10, 15, 20\}$. Draw the Hasse diagram for this relation.
- Define composition of functions. If $f, g: R \rightarrow R$, defined by $f(x) = x^2$, $g(x) = x + 1$. Find $f \circ g$, $g \circ f$, $g \circ g$. Determine whether $f \circ g$, $g \circ f$ are equal or not.
- Solve the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}$ with the initial conditions $a_0 = 1$, $a_1 = 6$
- Show that the function f defined on $R - \{1\}$ given by $f(x) = \frac{x+1}{x-1}$ is bijective. Also find its inverse.

Q.3) Attempt **any THREE** of the following. (15)

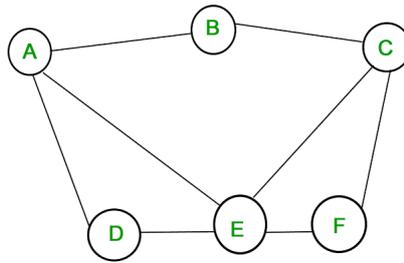
- How many different strings can be made by reordering the letters of the word “SUCCESS”?
- Explain Addition and Multiplication theorem of counting.
- How many strings of three decimal digits with repetition are there
 - That begin with an odd digit
 - Have exactly two digits that are 4's
- Let M be the finite state machine with the state table as follows.

	F	A	B
S ₀	S ₀	S _{2,x}	S _{1,z}
S ₁	S ₁	S _{2,x}	S _{3,y}
S ₂	S ₂	S _{2,y}	S _{1,z}
S ₃	S ₃	S _{3,y}	S _{0,x}

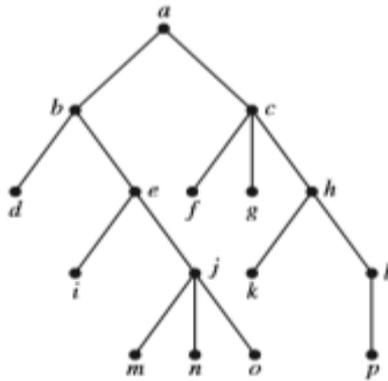
- Find the input set A, the state set S, the output set Z and the initial state of M.
 - Draw the state diagram $D = D(M)$ of M
 - Find the output word v if the input is the word $a = a^2 b^2 a b^2 a^2 b$
- Define a language L over an alphabet A. let $A = \{a, b, c\}$. find L^* where language $L = \{a, b, c^3\}$
 - State and prove Pascal's identity.

Q.4) Attempt **any THREE** of the following. (15)

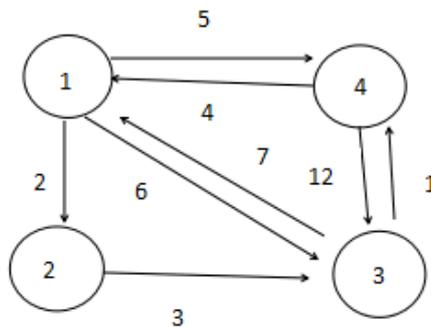
- What is adjacency matrix? Find the adjacency matrix for the following graph



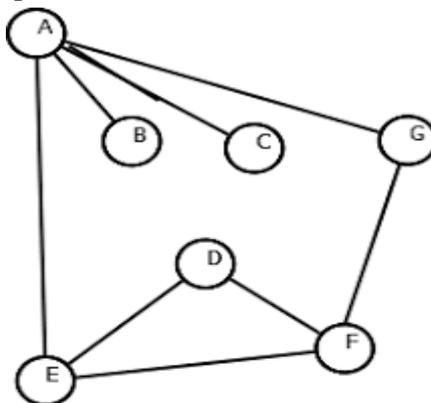
- (b) What is tree traversal? Traverses the given tree in inoreder, preorder, postorder.



- (c) Find the shortest path between the vertices by using Warshall's algorithm.

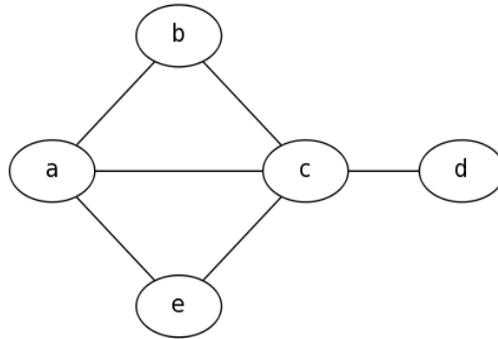


- (d) Find the spanning tree using breadth first search and depth first search of the following graph.



- (e) Write the definition of binary search tree. Draw the ordered rooted tree that represents the expression $((x+2) \uparrow 3) * (y - (3+x)) - 5$

- (f) Consider the following graph.
- Write definition of cycle.
 - Find all cycles in the graph
 - find all cycles including vertex 'a'



Q.5) Attempt **any THREE** of the following. (15)

- Solve the recurrence relation $a_r - a_{r-1} - 6a_{r-2} = -30$, with initial conditions $a_0 = 20, a_1 = -5$
- What is complete graph? Draw complete graphs on 4 and 5 vertices.
- Explain with example inserting and searching in a binary search tree.
- What is the coefficient of $x^{12}y^{13}$ in the expansion of $(x + y)^{25}$
- Prove that the function $f: R \rightarrow R$ defined by $f(x) = 3x - 7$ is bijective and also find its inverse.